

**SEDIMENT SAMPLING & ANALYSIS PLAN
PORTLAND HARBOR COMPARATIVE SAMPLING
STUDY AT POST OFFICE BAR, WILLAMETTE RIVER,
PORTLAND, OREGON**

July 2010

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ACRONYMS

Ag	Silver
As	Arsenic
Cd	Cadmium
CoC	Contaminate of concern
Cr	Chromium
Cu	Copper
EPA	Environmental Protection Agency
Hg	Mercury
IS	Incremental Sampling
J	Laboratory estimated value detected between MRL & MDL
MDL	Method Detection Limit
MLLW	Mean Lower Low Water
MRL	Method Reporting Limit
ND	Non-detected at MRL or MDL
NSM	New Surface Material - Exposed Surface after dredging
Ni	Nickel
Pb	Lead
PCB	Polychlorinated Biphenyl
PQL	Practical Quantitation Limit
PRG	Project Review Group
QA/QC	Quality Assurance/Quality Control
RMT	Regional Management Team
SAP	Sampling and Analysis Plan
Sb	Antimony
SEF	Sediment Evaluation Framework, 2009
SL	Screening Level
TOC	Total Organic Carbon
U	Laboratory non-detect at MRL
Zn	Zinc
Σ	Total value (i.e. DDT + DDE + DDD)

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1 PROJECT OVERVIEW

1.1 Project Description

The purpose of this project is to characterize dredged material using a modified incremental sampling (IS) approach concurrently with conventional sampling protocols found in the 2009 *Sediment Evaluation Framework for the Pacific Northwest* (SEF), and to compare the effectiveness and utility of each methodology. This sampling and analysis plan (SAP) covers the collection and chemical analyses of samples, but not evaluation of the utility of various compositing approaches for dredging projects, which will be the subject of a report completed after the sampling and analysis is completed.

IS was originally developed by the mining industry and was studied by the Corps for use at explosives-contaminated sites as a way to minimize sampling and subsampling errors by collecting a large number of closely-spaced surface soil samples that are then composited and submitted to a laboratory as a single sample. To the best of our knowledge, IS has not been used to characterize dredged material.

The primary goal of IS (as applied to dredged material testing) is to collect equal amounts of material (known as “increments”) from each core to create a “super-composite” of material weighing about 1,000 g (wet weight), and then extract and analyze a greater mass of material than what is typically analyzed under the SEF protocol. The results of the incremental approach will be compared to a more typical dredging sampling approach in a later report.

1.1 Project Site Location and Description

The Corps has selected Post Office Bar as the study area. The Post Office Bar Reach (WRM 2.2) is within the designated study area for the Portland Harbor CERCLA (Super Fund) site. The shoaling area is located within the Federal Navigation Channel (FNC) in the Lower Willamette River (LWR) at river mile 2.1-2.4. Figure 1 provides the vicinity map. The proposed dredging prism (DP) varies from 2 to 10-feet deep, with approximately 10% sand.

1.2 Historical Sediment Sampling

This area has been characterized in a 2009 study, which evaluated the material for open water disposal. The chemical data results exceeded the interim 2006 SLs in one or more samples for Cd, Zn, DDT, PCBs and PAHs. The CoCs were selected based on the Corps’ 2009 characterization of the site.

2 PROJECT PLANNING AND COORDINATION

2.1 Data Goals

- Characterize sediments utilizing an Incremental Sampling (IS) approach.
- Characterize sediments from individual cores for surface dredge prisms and new surface material (NSM) using methods found in the 2009 SEF.

- Characterize composited sub- surface core sections to represent discrete layers of the dredge prism.
- Analyze for full suite of physical parameters.
- Analyze for selected chemical analytes. See Table 1 for the list of analytes, methods of analysis, and method reporting limit requirements.

Table 1. List of Analytes, Analysis Methods, and Method Reporting Limits

Parameter	Prep Method	Analysis Method	Sample Quantitation Limit (SQL) ^{1/}
Total Solids (%)	---	EPA 2450-G	0.1
Total Organic Carbon (%)	PSEP 1997 and Bragdon-Cook 1993	EPA 5310B mod or EPA 9060	0.1
Grain Size (%)	---	PSEP 1986 or ASTM D-422 mod	1.0
Metals (mg/kg):			
Antimony	EPA 6010/6020 ^{2/}	EPA 6010/6020	0.5
Arsenic	EPA 6010/6020	EPA 6010/6020	5
Cadmium	EPA 6010/6020	EPA 6010/6020	0.5
Chromium	EPA 6010/6020	EPA 6010/6020	5
Copper	EPA 6010/6020	EPA 6010/6020	5
Lead	EPA 6010/6020	EPA 6010/6020	5
Mercury	EPA 7471	EPA 7471	0.05
Nickel	EPA 6010/6020	EPA 6010/6020	5
Silver	EPA 6010/6020	EPA 6010/6020	0.5
Zinc	EPA 6010/6020	EPA 6010/6020	5
Pesticides/PCBs (µg/kg):			
DDE (p,p', o,p')	EPA 3540	EPA 8081	2
DDD (p,p', o,p')	EPA 3540	EPA 8081	2
DDT (p,p', o,p')	EPA 3540	EPA 8081	2
Total PCBs	EPA 3540	EPA 8082	10
Total Petroleum Hydrocarbons (mg/kg):			
TPH-diesel	EPA 3630/ 3665	NWTPH-Dx	25
TPH-residual	EPA 3630/ 3665	NWTPH-Dx	50

^{1/} SQLs are based on dry sample weight assuming no interferences; site-specific method modifications may be required to achieve these SQLs in some cases.

2.2 Planning Team and Responsibilities

Table 2a lists Agency staff involved in the Project Team, and their duties and responsibilities for the sediment sampling project at Post Office Bar. Other agency staff will assist as needed. Table 2b lists primary AECOM staff involved in the Project Team, and their duties and responsibilities for the sediment-sampling project at Post Office Bar.

Table 2a, Planning Team and Responsibilities, Agency Staff

Task/Responsibility	James McMillan	Wendy Briner	Laura Inouye	Jeremy Buck	Dan Gambetta	Jonathan Freedman
Overall Project Management	X	X				
Sampling Plan Development	X	X	X	X		
Sampling Plan Review		X			X	X
Agency Coordination	X		X			
Positioning/Log Record						
Study Logistics	X	X				
Sediment Sampling	X	X	X		X	X
Compositing/Sub-sampling	X		X	X	X	X
Physical Analysis						
Chemical Analysis						
QAQC						
Final Data Report						

Table 2b, Planning Team and Responsibilities, AECOM

Task/Responsibility	Anne Fitzpatrick	Shannon Ashurst	Jason Palmer	David Scheuing Shewing	Mindy Graddon	Jennifer Wald
Overall Project Management	X	X				
Sampling Plan Development						
Sampling Plan Review	X	X	X			
Agency Coordination						
Positioning/Log Record			X		X	
Sediment Sampling		X	X	X	X	
Compositing/Sub-sampling		X		X		
Physical Analysis		X				X
Chemical Analysis		X				X
QAQC	X	X	X			
Final Data Report	X	X	X		X	X

3 SAMPLE COLLECTION AND HANDLING PROCEDURES

3.1 Sampling Device and Positioning

A vibra-core sampler will be used to collect sample cores. The objectives for the sample station horizontal positioning require an accuracy of plus or minus 3 meters. The objective for vertical position accuracy is plus or minus 0.5 foot. To meet these requirements, the instrument calibration and quality control procedures described below will be followed. Proposed coordinates will be determined from the Geographic Information Systems (GIS) maps prior to field mobilization.

Positioning and navigation for sediment sample locations will be accomplished using a differential global positioning system (DGPS) that allows sub-meter horizontal accuracy. For this project, sample locations will be surveyed using a Trimble 4000 DGPS, or equivalent, device. The positioning system will be calibrated over a known control point prior to the initiation of field activities to assure sub-meter location control accuracy.

Vertical elevation will be determined for all sample locations and will be logged in feet as depth to sediment ([DTS] mudline) from the water surface and water level to the nearest 0.5 foot. Measurements will be taken using graduated lead line and/or fathometer. The incremented lead line will be pulled taut from the bottom and measured. These measurements will then be confirmed with an electronic fathometer onboard the vessel.

In order to assure vertical control, these depth measurements will be correlated and tied into the Columbia River Datum (CRD). This is critical to achieve the precision required (+/-0.5 ft) to accurately identify the "Z Layer" located between -43 and -46 ft CRD. Daily tide fluctuations from the Vancouver, Washington (Columbia River) gauge and the Morrison Bridge gauge (Willamette River) in Portland, Oregon, will be used to correlate the cores to CRD.

3.2 Sampling Locations and Numbering

Figure 2 provides a site map with the proposed sampling locations and their coordinates at Post Office Bar. Table 3 lists the proposed sampling coordinates within POB reach. Coordinates are based on the Lambert Projection for Oregon; North Zone (NAD 83, U.S. Survey Feet), Datum is Columbia River Datum (CRD). CRD is 1.40 feet above National Geodetic Vertical Datum at Willamette River mile 0.4, 1947 adjustment. Cores shall not be collected in locations where the channel surface is currently deeper than -40 feet CRD (Columbia River Datum), to avoid collecting a dredge prism layer that is less than 4 ft deep. Current Corps-provided bathymetry will be used to determine the actual depth of sediment within the dredge prism and the length of cores that shall be needed to collect samples

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Thirty sampling locations have been selected within the project area. Proper QA/QC procedures as outlined in this section will be followed. Any deviation from these procedures shall be noted in the field log. Core identification shall use the following convention:

071510-POB-VC-YY

Where 07 represents the month, 15 the day and 10 the year (July 15, 2010), "POB" denotes samples collected from Post Office Bar, "VC" denotes the type of sampling device (vibracore); "YY" denotes the numeric sample sequence number and will consist of two digits for all samples, and an added "B" for the extra sediment required for laboratory QC.

Table 3. Proposed sampling coordinates and core IDs.

Core No./ID (Prefix: MMDDYY- POB-VC-)	Latitude (N)	Longitude (W)	Core No./ID (Prefix: MMDDYY- POB-VC-)	Latitude (N)	Longitude (W)
01	45.629606	-122.789243	17	45.630884	-122.788854
02	45.631363	-122.788391	18	45.630688	-122.788953
03	45.631145	-122.788499	19	45.630503	-122.789032
04	45.630943	-122.788597	19B	45.630503	-122.789032
05	45.630741	-122.788696	20	45.630330	-122.789116
06	45.630541	-122.788790	21	45.630141	-122.789203
07	45.630381	-122.788874	22	45.629945	-122.789299
08	45.630204	-122.788965	22B	45.629945	-122.789299
09	45.630003	-122.789061	23	45.629779	-122.789368
10	45.629807	-122.789153	24	45.629648	-122.789436
11	45.629686	-122.789605	25	45.629879	-122.789505
12	45.631021	-122.788956	26	45.630075	-122.789411
13	45.631230	-122.788858	27	45.630269	-122.789320
14	45.631445	-122.788762	28	45.630456	-122.789226
15	45.631299	-122.788646	29	45.630620	-122.789149
16	45.631095	-122.788745	30	45.630814	-122.789055
16B	45.631095	-122.788745			

3.3 Field Sampling Schedule

The Post Office Bar sampling event is scheduled for early to mid-August 2010. The specific dates are dependent on need and the ability to coordinate all required services prior to this date. Based on AECOM's estimate, we anticipate up to 6.5 days of field work and up to 1.5 days for mobilization/demobilization.

3.4 Field Notes and Sample Logging

Vibra-core sediment sampling will be used to collect the sediment cores at thirty locations (Figure 2). Vibra-coring will involve driving 4-inch outside diameter, up to 15-foot-long lightweight gauge aluminum metal core tubes equipped with a core-catcher to prevent sample loss upon retrieval.

At each sample location, a pre-cleaned core tube will be lowered over the side of the boat (using an A-frame-mounted winch) vertically through the water column until the bottom of the tube rests on the sediment mudline. The core tube will then be vibrated through the sediment column until refusal or full penetration of the tube has been reached, whichever is encountered first. The core tube will then be brought onboard.

Once onboard, the core tube will be inspected relative to the following criteria:

- Core tube is not overfilled.
- Overlying water is present and the surface interval is intact.
- Estimated compaction is not greater than 25 percent.
- Core tube appears intact without obstructions or blocking.

Field notes will be maintained during sampling operations. For each core sample, the following data shall be recorded in the field collection log:

- Date
- Coordinates of sample
- Core sample ID
- Water depth
- Sample recovery including description of core tube (e.g., intact, bent)
- Odor (e.g. hydrogen sulfide, petroleum products, etc.),
- Presence of oil sheen,
- Any core attempts that failed to obtain the needed sample, and explanation of what happened
- Any deviation from the sampling plan

When an individual core recovery does not achieve desired recovery criteria (including the core length recovery as identified in Figure 2), up to two additional cores will be collected to attempt to meet the desired recovery standards. All attempts will be made within 20 feet of the proposed sample location. If all three attempts result in not being able to satisfy the desired recovery criteria, the core sample judged to most closely meet the recovery criteria will be designated for further sediment processing. In this case, the Corps project manager will be immediately notified of the situation. The contents from the other cores will be collected for disposal.

A separate log will be maintained during core processing and compositing. A copy of Table 4 (compositing scheme) will be kept on-site and available for easy reference. The following data shall be recorded in the field processing log:

- Date
- Core identification number
- Sample recovery
- Identification of which core samples were selected as QC field replicates, and the QC field replicate ID number
- Physical -description (including sediment grain size, density/consistency of sediment, and color),
- Odor (e.g. hydrogen sulfide, petroleum products, etc.),
- Visual stratification and lenses,
- Vegetation,
- Debris,
- Biological activity (e.g. detritus, shells, tubes, bioturbation, live/dead organisms, etc.),
- Presence of oil sheen,
- Any other distinguishing characteristics or features
- Any deviation from the sampling plan

3.5 Decontamination

All sampling devices and utensils (used during sampling, and core processing/compositing activities) will be thoroughly cleaned prior to use according to the following procedure:

- Rinse with river water
- Wash with brush and Alconox soap
- Rinse with distilled water.

Utensils used to collect physical samples only or sampling devices such as the vibra-core device will be washed down before each sampling event. However, they will not require the cleaning procedure listed above as long as samples collected for chemical analyses are not in contact with the core walls. All utensils used to collect chemical samples will require decontamination prior to each use. All handwork for chemical analyses will be conducted with disposable gloves that will be rinsed with distilled water before and after handling each individual sample, as appropriate, to prevent sample contamination. Gloves will be disposed of between samples or composites to prevent cross contamination between samples.

3.6 Core Processing and Compositing

Due to the complexity of the compositing scheme, all cores will be taken to the Corps' Moorings facility (Willamette River, RM 6) for processing and compositing. Samples will be processed daily as cores are taken. Some composites may not be completed for several days due to the time required for obtaining the cores. In these cases, the containers used for composites and super-composites will be stored covered and in the dark at 4° C until all cores required for the composite are processed.

Commented [A1]: There are only the super-composites (i.e., IS samples), correct?

Sediment core samples will be processed, sediment composites prepared, and samples transported to ARI for analysis, as outlined below:

- Intact sediment cores or core sections are delivered to the processing site following collection. The cores/core sections when received will either be stored in iced containers until processed, or processed immediately depending on schedule and logistics. All cores will be processed within 24-hours of receipt.
- In a designated work area, each core will be cut in half length-wise using a circular band saw and "laid-open" to show two separate halves of the same core for core logging.
- The profile will be visually logged for major and minor contacts. Stainless steel spoons, small spatulas, photographs, and a tape measure are used in the logging process. The core will be logged using ASTM (2001) Visual Classification Methods (D-2488) by a qualified geologist.
- After logging, sediment from designated sampling intervals will be composited as described in section 3.6.1 (Conventional Samples) and 3.6.2 (IS Cores), and placed into pre-cleaned, labeled jars or clean plastic bags (IS sample composites) for chemical and physical analyses. To prevent potential sample contamination, care will be taken at this step to not use sediment adjacent to the core tube.
- For the IS sample composites, compositing will be done at the core processing site. Since the IS composite will take multiple days to collect, the sample receptacle will be stored at the appropriate temperature, except for brief periods during which the jar(s)bags will be removed from refrigeration to accept additional material.
- Conventional samples will be shipped priority overnight to ARI at the end of each field day (or early the following morning) under chain-of-custody procedures.

- Upon completion of the sample processing, all remaining sediment not used for testing will be placed in a 55-gallon drum for subsequent appropriate disposal depending on sample results. The two halved sediment tubes will be cleaned and recycled.

The cores will be delineated into two layers of uniform thickness, the A layer and the Z (new surface material) layer. This will leave a variable-thickness unit, the B layer, between the A and Z layers which will not be sampled or analyzed. The A layer shall be 4-feet thick, as measured from the elevation of the existing surface. The Z layer is a uniform thickness from -43 to -46 feet CRD. Refer to Table 4 for an overview of the compositing scheme.

Sample identification shall use the following convention:

POB-AA-BB-C

Where "POB" denotes samples collected from Post Office Bar, "AA" denotes the type sample (IS = incremental sampling, CV- conventional sampling; "BB" denotes the sample number outlined in Table 4, and "C" denotes the layer (A or Z) being analyzed.

Blind field replicates will be designated using the following convention:

POB- AA -FR-YY

Where "POB" denotes samples collected from Post Office Bar, "AA " denotes the type sample (IS = incremental sampling, CV- conventional sampling); "FR" denotes the sample is a blind field replicate, and "YY" denotes the assigned number of the sample (01 through 07).

Additional samples required for laboratory QC will be required for conventional sampling. These samples will be designated using the following convention:

POB- AA - BBb -C

Where "POB" denotes samples collected from Post Office Bar, "AA " denotes the type sample (IS = incremental sampling, CV- conventional sampling; "BB" denotes the sample number outlined in Table 4 with the small "b" being used for the extra jars required for laboratory QC purposes (will require "a" through "d" for the three A layers and three Z layer samples selected for laboratory QC purposes), and "C" denotes the layer (A or Z) being analyzed.

3.6.1 Conventional Sample Core Processing

For the conventional sample processing, cores 22, 19, and 16 will require collection of two cores to provide sufficient sample volume for laboratory QC replication. These cores should be logged, divided horizontally into A and Z layers. For each pair of cores, vertical "scrapes" of each core shall be spooned into stainless steel bowls, and composited until uniform in color and texture, before filling the required jars (~~two one~~ 16-oz jars, ~~one two~~ 8 oz jars, and one 4 oz jar per sample)^{1,2}. Sample can be collected

Commented [A2]: C? Three QC samples (a-c), or would the "parent" sample be "a"?

Commented [A3]: Correct

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¹ If necessary to meet sample volume requirements, sediment contacting the core tube can be used for physical samples only.

² The laboratory QC replicate samples will not be submitted for physical analyses, so will have only one 16 oz jar rather than two.

from both sides of the core from the secondary core; the primary core should have half the core reserved for the IS sampling approach³.

The remaining 27 vibra-core samples shall be logged and divided horizontally for a total of 54 samples from the A and Z layers. Vertical “scrapes” of each core shall be spooned into stainless steel bowls, and composited until uniform in color and texture, before filling the required jars (one 16-oz jars, one two 8 oz jars, and one 4 oz jar per sample)³.

Blind field replicates will be collected and submitted for analysis by filling a second set of jars during core processing. For the A and Z Layers, three blind field replicate samples will be randomly selected for each layer (6 total). These blind field replicates will be identified in the field compositing log and clearly associated with a specific core in the log, but will be assigned a number from 1 to 6.

These 66 samples [30 A layer (with three samples having extra jar sets for lab QC) + 30 Z layer + 6 field replicates] shall then be submitted for chemical and physical analysis, ~~as applicable.~~

Commented [A4]: This superscript has issues- we are field compositing into a large container (bag) for the IS approach. No jars will be used for this.

AECOM: Have revised per our 7/29 phone call.

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³ As shown in Table 4, the field duplicate and laboratory QC samples for the IS samples will be collected from the A layer. To ensure adequate volume, ~~three an additional 8- oz jars (one to contribute to for each IS sample) will be collected for compositing. Because volume is more constrained in the Z layer and no duplicates or replicates are to be analyzed for that layer, 4- oz jars will be used to will be collected for each the IS sample sediment.~~

Table 4. Compositing Scheme: Conventional and IS Sampling IDs, and Corresponding Core IDs.

Core ID	Conventional Samples		IS Samples	
	A	Z	A	Z
XXXXXX-POB-VC-01	1	1	3	3
XXXXXX-POB-VC-02	1	1		
XXXXXX-POB-VC-03	1	1		
XXXXXX-POB-VC-04	1	1		
XXXXXX-POB-VC-05	1	1		
XXXXXX-POB-VC-06	1	1		
XXXXXX-POB-VC-07	1	1		
XXXXXX-POB-VC-08	1	1		
XXXXXX-POB-VC-09	1	1		
XXXXXX-POB-VC-10	1	1		
XXXXXX-POB-VC-11	1	1		
XXXXXX-POB-VC-12	1	1		
XXXXXX-POB-VC-13	1	1		
XXXXXX-POB-VC-14	1	1		
XXXXXX-POB-VC-15	1	1		
XXXXXX-POB-VC-16	1	1		
XXXXXX-POB-VC-16B*	1	1		
XXXXXX-POB-VC-17	1	1		
XXXXXX-POB-VC-18	1	1		
XXXXXX-POB-VC-19	1	1		
XXXXXX-POB-VC-19B*	1	1		
XXXXXX-POB-VC-20	1	1		
XXXXXX-POB-VC-21	1	1		
XXXXXX-POB-VC-22	1	1		
XXXXXX-POB-VC-22B*	1	1		
XXXXXX-POB-VC-23	1	1		
XXXXXX-POB-VC-24	1	1		
XXXXXX-POB-VC-25	1	1		
XXXXXX-POB-VC-26	1	1		
XXXXXX-POB-VC-27	1	1		
XXXXXX-POB-VC-28	1	1		
XXXXXX-POB-VC-29	1	1		
XXXXXX-POB-VC-30	1	1		
Field Duplicate	3	3	1	0
Laboratory QC	9	9	3	0
Subtotals	42	42	7	3
Total	94			
* - a second core will be taken at these locations to collect enough material for the conventional sampling laboratory QC. These cores will NOT be used for the IS sampling.				

3.6.2 IS Core Processing

For the IS core processing, approximately thirty-five (35) grams of sediment shall be collected from each A and Z layer EXCEPT the three extra cores collected for the conventional sampling laboratory QC, which will not be used for the IS sampling; all “A” samples will be placed into one container for mixing, and all “Z” samples will be placed in a different container for mixing. Upon completion of sampling, all of the “A” material shall be composited into one sample and “Z” material into a second sample. This will result in an approximately 1000 g sample, from which both physical and chemical analyses must be conducted. This process shall be conducted twice more to generate three separate A layer samples and three separate Z layer samples.

A blind field replicates of the “A” layer will be collected and submitted for analysis by filling a fourth set of jars/bag will during core processing.

These seven samples (3 A layer + 3 Z layer + 1 field replicate) shall then be submitted for chemical and physical analysis.

3.7 Sample Transport and Chain-of-Custody

Upon completion of sampling, sample containers shall be packed in dry ice, “blue ice”, or crushed ice in coolers to maintain an arrival temperature of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Chain-of-custody procedures shall commence in the field and track delivery of samples. Sample holding times and storage requirements are presented in Table 5.

Table 5. Sample holding times and storage requirements.

Group	Analyte	Method	Holding Time 4°C	Holding Time -18°C	Container Requirements
Chemical Analyses					
A	Pesticides/PCBs	EPA 8081 and 8082 (SW846)	10 days to extraction, 40 days from extraction to analysis	1 year	8-ounce Glass
B	Metals ¹	EPA 6010A/7000 or 6020 series	6 months (except freeze mercury ²)	2 years (28 days for mercury)	4-ounce Glass
C	Mercury	EPA 245.740, or 7471			
D	Total Organic Carbon (TOC) Total Solids	EPA (SW846) 9060 / PSEP SM 2540B	14 days	6 months	
E	NW-TPH-HCID	NW-TPH-HCID	14 days	1 year	8-ounce Glass (provides additional volume for extremely wet samples)
	NW-TPH-HCID-Dx	NW-TPH-HCID-Dx			
	NW-TPH-HCID-Rx	NW-TPH-HCID-Rx			
Physical Analyses					
F	Grain Size Only		1 year, room temp.	NA	16-oz Plastic (full container)
	Particle Size	ASTM D422 (modified)			
	Hydrometer	ASTM D422			

Notes:

¹ = Metals include Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn.

² = Freezing mercury samples is most applicable to methylmercury and mercury speciation analyses (S. Dunthoo, ARI, personal communication, 5/24/10).

- Samples shall be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24 or delivered directly to the testing laboratory.
- Individual sample containers shall be packed to prevent breakage.
- Coolers shall be clearly labeled with sufficient information to enable positive identification. As a minimum, the following is required:

Commented [A5]: Should we add another field to the end of the IS sample IDs to differentiate each of the 3 samples – e.g., POB-IS-01-A-1, POB-IS-01-A-2, and POB-IS-01-A-3? So that all the “IS-YY-A-1” samples would be composited into one sample, all the “IS-YY-A-2” samples would be composited into another sample, etc.

Commented [A6]: Field compositing avoids the need for this, and also eliminated potential mistakes in the lab compositing.

Commented [A7]: Updated per our 7/29 call.

- Name of project.
- Time and date container was sealed.
- Personnel sealing cooler.
- Office name and address.
- Custody seals shall be used on cooler(s) during shipment.
- Chain-of-custody forms shall be enclosed in a plastic bag and placed inside cooler. Upon transfer of sample possession to laboratory, personnel transferring custody of coolers shall sign the chain-of-custody form. Personnel receiving cooler shall inspect the cooler(s) and record the condition of the samples.
- Custody Seals will be used on cooler during shipment.

4 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

4.1 Laboratory Analysis Protocols

AECOM or their sub-contractors, private contract analytical chemical laboratories, will conduct all physical and chemical analyses. Laboratory testing procedures will be conducted in accordance with the SEF, with modifications for the IS approach. Laboratory sampling and the weight of material to be extracted for the IS samples are different than conventional laboratory procedures. The contract laboratory should be able to perform modified analytical sample collection and extraction procedures per Appendix A.

The IS modification approach is briefly summarized as follows:

In the laboratory, a representative subsample shall be hand collected by taking 30 small increments from systematic random locations from the sample spread out to a thin layer in a clean pan. The material should be stirred prior to sub-sampling with a clean spoon to break up clumps if necessary. For organics analysis, one gram increments shall be collected to obtain 30 grams of extractable mass of dried sediment for each extraction. For inorganic analysis, at least 30 increments should be collected to obtain a minimum of 5 and preferably 10 grams for each extraction (i.e., each increment would contain about 0.16 g of material to obtain roughly 5 grams total and about 0.33 g to obtain 10 grams of material).

For QC purposes, the contracted analytical laboratory will randomly select one IS sample from the A layer as a QC replicate. For conventional sampling, the lab shall run lab QC analyses on three randomly selected samples from the A layer and three randomly selected samples from the Z layer. See section 4.7 for more details on the QC replicates.

For the IS approach, field duplicates and QC replicates included, there should be 10 total IS analyses (6 IS samples + 1 IS field replicate + 3 lab QC analyses on a single, randomly selected IS sample). For the conventional sampling approach there should be a total of 84 analyses [(30 discrete A layer + 3 A layer field replicates + 3 triplicate (9) A layer lab QC) + (30 discrete Z layer + 3 Z layer field replicates + 3 triplicate (9) Z layer lab QC)].

4.2 Chain-of Custody Procedures

A chain-of-custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory includes sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

4.3 Limits of Detection

All reasonable means, including additional cleanup steps and method modifications, will be used to meet target levels for all analytes (Table 1). Detection of analytes between the Method Reporting Limit (MRL) and the Method Detection Limit (MDL) should be "J" flagged and reported as an estimate.

4.4 Sediment Chemistry

Analyses ~~will be split into two groups. Group 1 shall be analyzed for all samples, and Group 2 will be analyzed on a smaller subset of samples.~~

~~Group 1 analytes~~ shall include:

- Organochlorine Pesticides and PCBs
- Metals (9 inorganic)
- Mercury (metallic)
- Total Organic Carbon
- Physical analyses (~~TOC~~total solids, grain size)
- Total Petroleum Hydrocarbons (NW-HCID screen, with follow-up)
 - TPH-Diesel
 - TPH-Residual

~~Group 2 will be analyzed for conventional samples from cores 2, 5, 7, 10, 11, 14, 16, 20, 26, and 29, the three incremental sampling "A" layer samples and its field duplicate, and the three incremental sampling "Z" layer samples. Group 2 analytes shall include:~~

- ~~• Phenols~~
- ~~• Phthalates,~~
- ~~• Miscellaneous Extractables~~
- ~~• Polynuclear Aromatic Hydrocarbons~~

4.5 Sediment Conventional

Particle grain size distribution for each sample will be determined. Sieve analysis will use a geological sieve series, which will include the sieve sizes U.S. Nos. 5, 10, 18, 35, 60, 120, and 230. Hydrogen peroxide will not be used in preparations for grain-size analysis. Hydrometer analysis will be run on particle sizes finer than the 230 mesh. Analyses will also include Moisture content and Total Organic Carbon (TOC) (EPA (SW 846) 9060).

Commented [A8]: This was not specified at the time of the original proposal; cost to add would be \$20/sample. Sorry we didn't catch this with the previous read-through.

4.6 Holding Times

All samples for physical and chemical testing will be maintained at the testing laboratory at the temperatures specified in Table 5 and analyzed within the holding times shown in the table.

4.7 Quality Assurance/Quality Control

The lab will use the applicable chemistry QA/QC procedures as presented in Table 6, as summarized below:

- For "Group 1" and "Group 2" analyses, Laboratory QC replicates shall include an additional triplicate analysis for the three selected QC replicates for the conventional "A" layer sampling the three selected QC replicates for the conventional "Z" layer sampling, and one of the IS "A" layer samples.
 - For the conventional sampling, QC replicates were selected in the field due to the extra sediment requirements for analysis. Three cores were selected and additional jars filled for the lab QC analysis as described in section 3.6.1.
 - For the IS samples, there should be sufficient sample within each A layer IS composite to allow for the additional analyses. As indicated previously, QC replicates will be selected by the lab from one A layer composite sample.
- Method blanks shall be run for ~~semivolatiles~~, pesticides, PCBs, and TOC.
- For ~~semivolatiles~~, pesticides, and PCBs, initial calibration will be required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.
- For ~~semivolatiles~~, pesticides, and PCBs, matrix spike duplicates will be run.
- Reference materials shall be analyzed for pesticides (e.g., Canadian standard SRM-1), PCBs (e.g., Canadian standard SRM-1), and TOC (e.g., NIST certified reference material 2704).
- For ~~semivolatiles~~, pesticides, and PCBs, surrogate spikes will be included with every sample, including matrix-spiked samples, blanks and reference materials

Table 6. Minimum Analytical QA/QC procedures.

Analytical Type	Method Blank ²	Duplicate ²	RM ^{2,4}	Matrix Spikes ²	Surrogates ⁷
Pesticides/PCBs ¹	X	X ³	X ³	X	X
Metals	X	X	X ⁶	X	
Total Organic Carbon	X	X	X ⁶		
Total Solids		X			
Particle Size		X			

4.8 Laboratory Report

The analytical laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- A cover letter discussing analytical procedures and any difficulties that were encountered.
- Results of the laboratory analyses and QA/QC results.
- All protocols used during analyses.
- Chain of custody procedures, including explanation of any deviation from those identified herein.
- Any protocol deviations from this SAP.

In addition to the written report, data will be submitted in electronic table format such as in an Excel spreadsheet.

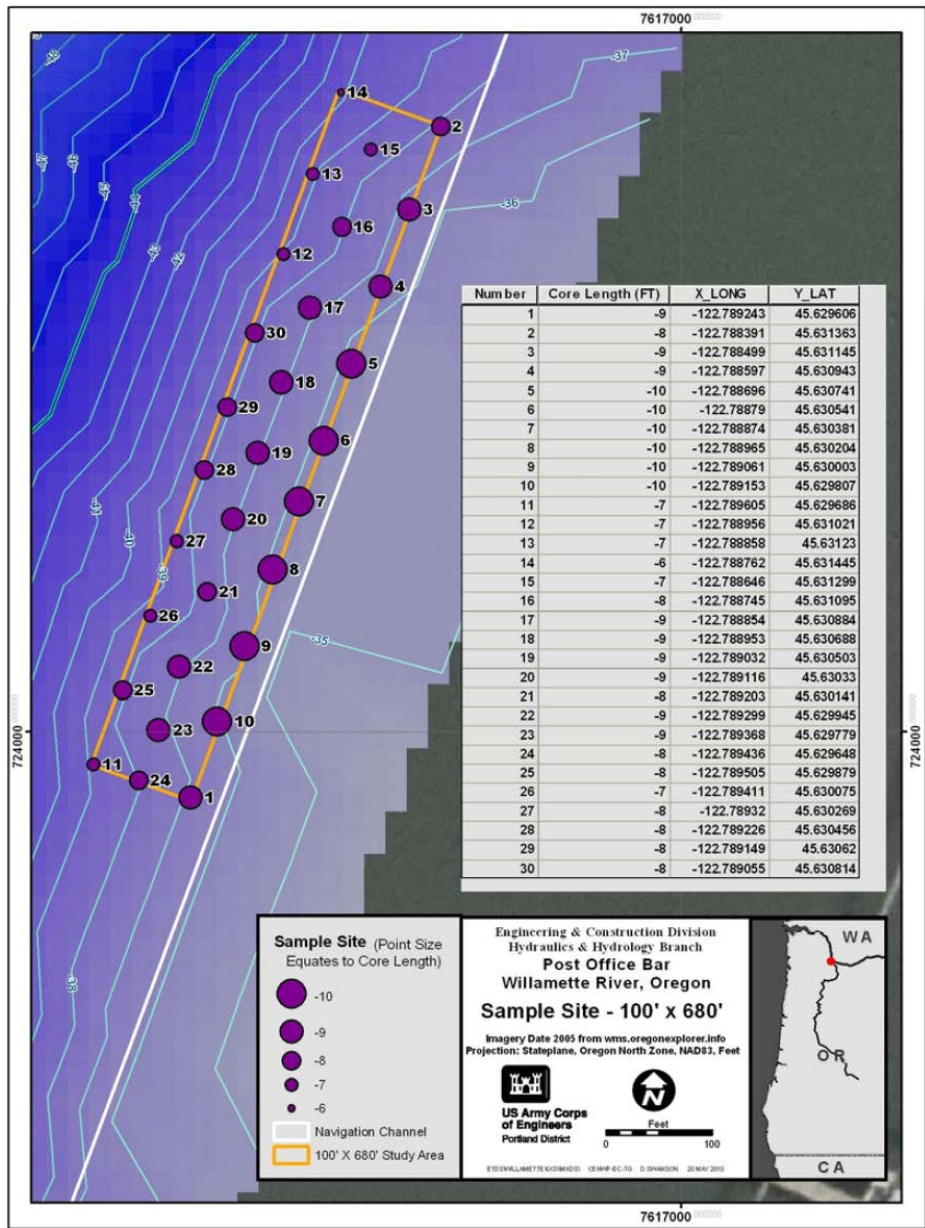
5 FINAL REPORT

AECOM will generate a brief final report which shall contain a summary of PAH, pesticide, and metals data in table format. Additionally, the report will summarize the field event, document any modifications to the SAP, and provide final core logs. Statistical analysis and data validation (other than the QC checks provided by the laboratory) will not be required. All data shall be provided electronically.

Figure 1: Willamette River, Post Office Bar, Vicinity Map



Figure 2. Map of project area with sampling locations, coordinates, and estimated material thickness.



APPENDICES

APPENDIX A

LABORATORY PREPARATION OF INCREMENTAL SAMPLING

SEDIMENT SAMPLES

The following discussion and laboratory methods shall be applied to the incremental sampling (IS) samples only.

Sub-sampling is used to provide a representative laboratory sub-sample (and any lab replicates) for a single IS sample, and to provide representative sub-samples for multiple analyses. The mass of sample needed for extraction for the subject analytical test is used to select the mass of each increment when hand collecting the sub-sample. It is critical that the entire mass of **dried sample** is used for the sub-sampling process (as described below).

The Gy sampling theory, which is the foundation of this IS approach, is also the basis of two primary references on laboratory sub-sampling and analysis of particulate samples: United States Environmental Protection Agency (U.S. EPA, 2003) and American Society for Testing and Materials (ASTM 2003). These are recommended as lab guidance for sub-sampling sediment collected for the Corps' Portland Harbor Comparative Sampling Study. Of all the steps necessary to process and analyze environmental samples, laboratory sub-sampling is arguably considered to contribute the greatest potential for error. The above-referenced lab sub-sampling guidance applies to all types samples collected in the field, whether IS, discrete, or judgmental samples.

One issue discussed in both the U.S. EPA and ASTM guidance documents is the choice of a minimum sub-sample mass for extraction/analysis of sediment samples in order to reduce "fundamental error" of the laboratory analyses to approximately 15% or less. The minimum appropriate mass is based on the maximum particle size in the sediment samples. For samples with a maximum particle size of <2mm, the minimum analysis mass is 10 grams. This is a minimum analysis mass; there could be cases where this mass is not sufficient to reduce error. In general it is preferable to increase the minimum analysis mass if possible, to reduce opportunity for error.

The field IS samples shall be submitted to the laboratory for processing and analysis after retrieval in the field and removal of foreign objects and larger particles. The target mass of the field IS samples received by the laboratory shall be at least 500 g of material (dry weight). Typically, an ideal sample shall contain particle sizes less than 2 mm, and it is expected that the sediments in the study area shall consist primarily of fine materials less than 2 mm and sieving shall not be necessary.

In the laboratory, the IS samples shall be air dried. Contaminant analyses of all sediment samples (regardless of how they were collected) are required to be reported on a dry weight basis (if samples are air dried prior to analysis, resulting analyses would be considered dry weight analyses). In the laboratory, a representative subsample shall be hand collected by taking 30 small increments from systematic random locations from the dried sample spread out to a thin layer in a clean pan. The

Commented [A9]: Attachment A of our proposal provided a modified IS approach for dealing with sediments, since air drying sediments affects many of the target compounds of interest.

Per Mr. McMillan (7/23/10), the intent is to do the modified IS approach for sediments, so this appendix will need to be updated.

material should be stirred prior to sub-sampling with a clean spoon to break up clumps if necessary. For organics analysis, one gram increments shall be collected to obtain 30 grams of extractable mass of dried sediment for each extraction. For inorganic analysis, at least 30 increments should be collected to obtain a minimum of 5 and preferably 10 grams for each extraction (i.e., each increment would contain about 0.16 g of material to obtain roughly 5 grams total and about 0.33 g to obtain 10 grams of material).

References

U.S. Environmental Protection Agency. 2003. Guidance for obtaining representative laboratory analytical subsamples from particulate laboratory samples. EPA/600/R-03/027. Website URL: http://www.epa.gov/tio/download/char/epa_subsampling_guidance.pdf.

ASTM, 2003. Standard guide for laboratory subsampling of media related to waste management activities: D6323-98(2003). West Conshohocken, PA: ASTM International.

Commented [A10]: As previously discussed with the Corps, ARI, like most labs, no longer maintains equipment designed to accommodate large sample sizes as proposed here. The lab folks are of the mind that, as long as the samples are thoroughly homogenized, this is less of an issue anyway.

The only lab ARI has found that could handle this extraction (i.e., this volume of material) only has WA Ecology certification, and it would be very difficult to take that lab's digests and run them through ARI's systems and build a Level IV package. **Note:** If you want to go this route (understanding that data quality will be less reliable), costing will need to be adjusted as this wasn't factored into the proposal.